November 13, 2003

Mr. James Mallay
Director, Regulatory Affairs
Framatome ANP, Richland, Inc.
2101 Horn Rapids Road
Richland, WA 99352

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION - BAW-10231P, CHAPTER 13, "COPERNIC MOX APPLICATIONS"

Dear Mr. Mallay:

By letter dated July 31, 2000, Framatome submitted for staff review Topical Report BAW-10231P, Chapter 13, "Copernic MOX [Mixed Oxide] Applications." The staff has completed its preliminary review of BAW-10231P, Chapter 13 and has identified a number of items for which additional information is needed to continue its review. The enclosed request for additional information (RAI) was discussed with your staff on April 23, 2002. A mutually agreeable target date of July 7, 2002, was established for responding to the RAI. Partial submittals would be welcomed to minimize delays.

Pursuant to 10 CFR 2.790, we have determined that the enclosed RAI does not contain proprietary information. However, we will delay placing the RAI in the public document room for a period of ten (10) working days from the date of this letter to provide you with the opportunity to comment on the proprietary aspects only. If you believe that any information in the enclosure is proprietary, please identify such information line by line and define the basis pursuant to the criteria of 10 CFR 2.790.

If you have any questions, please call me at (301) 415-1436.

Sincerely,

/RA/

Drew Holland, Project Manager, Section 2
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Request for Additional Information

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REQUEST FOR ADDITIONAL INFORMATION

BAW-10231P. CHAPTER 13, "COPERNIC MOX APPLICATIONS"

1. Please provide densification and swelling data that demonstrate that the UO2 densification and swelling models may be applied to the Framatome fabricated mixed oxide (MOX) using the MIMAS (MIchronized MASter blend) process from ammonium di-uranate (ADU) powder. Also provide information on how Framatome assures that the PuO_2 powder supplied by the Department of Energy will behave similarly to that previously fabricated by Framatome and that the densification and swelling MOX data supplied to the NRC in the July 31, 2000, submittal remains applicable.

2. Please compare COPERNIC predicted MOX radial Pu distributions at different burnup levels to measured radial Pu distributions at the same burnup levels. Also compare COPERNIC predicted MOX radial burnup distributions to those measured radial burnup distributions at different burnup levels. List the initial starting Pu distributions for the data.

3. Please supply any new data that has been obtained since the issuance of the topical report related to MOX behavior/properties such as fission gas release, fuel swelling, thermal conductivity, and thermal expansion.

4. The COPERNIC thermal conductivity model does not appear to account for changes in stoichiometry of MOX with irradiation. This is of concern because it has been proposed in the literature (Duriez et al., J. Nuc Mater. 277: 143 – 158) that MOX fuel may become more hypostoichiometric due to an increase in oxygen vacancies with increasing burnup and, therefore, result in more thermal conductivity degradation in addition to the degradation due to irradiation and fission products. Please provide data and analysis demonstrating that the COPERNIC assumption of no thermal conductivity degradation due to MOX stoichiometry changes with burnup is valid.

5. The application of COPERNIC for MOX temperature predictions assumes that the uncertainty for MOX is the same as for UO_2 fuel temperature predictions. This assumption is questionable, particularly at higher burnups (>25 GWd/MTU) because there are no centerline temperature data and no thermal diffusivity data for MOX fuel at these burnups. In addition, there may be further reduction in MOX thermal conductivity at higher burnups if the MOX becomes more hypostoichiometric with increasing burnup (see Question 4 above). Please justify why the COPERNIC calculated temperature uncertainty for UO_2 can be applied to MOX at burnups greater than 25 GWd/MTU without data to confirm this assumption.

6. The following additional input data are needed for Pacific Northwest Laboratory to perform audit analyses of COPERNIC example results of MOX licensing analyses:

   The axial power shapes used for steady-state power operation for example licensing analyses were not found in the topical report. Please provide these axial power shapes in electronic format if possible. Please provide the radial power shapes as a function of burnup for these analyses.

What is the assumed stoichiometry of the MOX for these analyses and how does this compare to the specification on stoichiometry for MOX for commercial application? Do these analyses include possible changes in stoichiometry with burnup (see Question 4 above) and, if so, what are the assumed changes?